Translating effective web-based self-help for problem drinking into the real world

Riper, H.; Kramer, J.; Conijn, B.; Smit, H.F.E.; Schippers, G.; Cuijpers, P.

published in
Alcoholism, Clinical and Experimental Research
2009

DOI (link to publisher)
10.1111/j.1530-0277.2009.00970.x

document version
Publisher's PDF, also known as Version of record

Translating Effective Web-Based Self-Help for Problem Drinking Into the Real World

Heleen Riper, Jeannet Kramer, Barbara Conijn, Filip Smit, Gerard Schippers, and Pim Cuijpers

Background: Drinking Less (DL) is a 24/7 free-access anonymous interactive web-based self-help intervention without therapeutic guidance for adult problem drinkers in the community. In a randomized controlled trial (referred to here as DL-RCT), DL has been shown effective in reducing risky alcohol consumption.

Objective: To assess whether the findings of DL-RCT are generalizable to a naturalistic setting (DL-RW) in terms of ability to reach the target group and alcohol treatment response.

Methods: Pretest–posttest study with 6-month follow-up. An online survey was conducted of 378 of the 1,625 people who used DL-RW from May to November 2007. Primary outcome measures were (1) problem drinking, defined as alcohol consumption in the previous 4 weeks averaging >21 or >14 standard units (male/female) per week or ≥6 or ≥4 units (m/f) on 1 or more days per week; and (2) mean weekly alcohol consumption. DL-RW and DL-RCT data were compared and pooled. Intention-to-treat (ITT) analysis was performed to analyze and compare changes in drinking from baseline to follow-up.

Results: In the DL-RW group, 18.8% ($n = 71$) were drinking successfully within the limits of the Dutch guideline for low-risk drinking ($p < 0.001$) 6 months after baseline (ITT). The DL-RW group also decreased its mean weekly alcohol intake by 7.4 units, $t(377) = 6.67$, $p < 0.001$, $d = 0.29$. Drinking reduction in DL-RW was of a similar magnitude to that in the DL-RCT condition in terms of drinking within the guideline [$\chi^2(1) = 1.83$, CI: 0.82–3.00, $p = 0.18$, RD = 0.05, OR = 1.55] and mean weekly consumption (a negligible difference of $d = 0.03$ in favor of DL-RW group).

Conclusion: The results from DL-RCT and DL-RW were similar, and they demonstrate that web-based self-help without therapeutic guidance is feasible, well accepted, and effective for curbing adult problem drinking in the community.

Key Words: Randomized Controlled Trial, Problem Drinking, Web-Based Self-Help, Real-World Setting.

A MAJOR CHALLENGE in a public health approach to problem drinking is the effective implementation of evidence-based self-help interventions in the community (Glasgow and Emmons, 2007; Moyer et al., 2002; Riper et al., 2009). The need for such interventions is clear. The prevalence of problematic alcohol use in Western societies is as high as 10% of the adult population; problem drinking has been identified as the third leading cause of morbidity and mortality on a par with tobacco (Room et al., 2005) and it brings high social and economic costs in its train (Smit et al., 2006; World Health Organization, 2007). Yet only 10 to 20% of people with alcohol problems ever seek and engage in treatment (Harris and Mckellar, 2003; Kohn et al., 2004). This means there are substantial unmet needs among the problem-drinking population (Grant, 1997; Lieberman and Huang, 2008). Moreover, while brief interventions with some form of professional guidance in primary care have been shown to be effective beyond doubt, there are barriers to implementing them on any large scale, and their potential for a real public health impact remains unrealized (Beich et al., 2002, 2003). Web-based self-help interventions for problem drinking could be a promising complement that could help overcome some of the implementation problems. These can be provided on a broad scale at reasonable cost. They hold some appeal to problem drinkers (Cunningham et al., 2000; Koski-Jannes et al., 2007) and they fit well into an era in which self-help in good and ill health are becoming essential components of our health-care system.

As yet, little is known about how to translate problem-drinking interventions tested in randomized trials into more naturalistic settings, and that applies even more so to the new

From the Innovation Centre of Mental Health and Technology (HR, JK, BC, FS), Trimbos Institute (Netherlands Institute of Mental Health and Addiction), Utrecht, The Netherlands; Department of Clinical Psychology and EMGO Institute (HR, FS, PC), VU University Medical Centre, Amsterdam, The Netherlands; and Amsterdam Institute for Addiction Research (GS), Academic Medical Centre, University of Amsterdam, Amsterdam, The Netherlands.

Received for publication September 11, 2008; accepted March 14, 2009.

Reprint requests: Heleen Riper, Innovation Centre of Mental Health and Technology, Trimbos Institute (Netherlands Institute of Mental Health and Addiction), PO Box 725, 2500 AS Utrecht, The Netherlands; Fax: +31-30-297-1111; E-mail: hriper@trimbos.nl

DOI: 10.1111/j.1530-0277.2009.00970.x

generation of web-based interventions. Some studies do provide insights into the effectiveness of web-based or television-based self-help interventions for problem drinkers (Hester et al., 2005; Kramer et al., 2009; Kypri et al., 2004b; Riper et al., 2008b) or into how these operate in public Internet settings (Cunningham et al., 2005; Linke et al., 2007; Saitz et al., 2004). All studies conclude nonetheless that further research is needed to (1) test such interventions more thoroughly in clinical trials and (2) assess the effectiveness of web-based self-help when delivered under real-world conditions (Kypri et al., 2008). To the best of our knowledge, no studies have yet been published that address this question. Some initial positive answers have, however, been provided for web-based self-help for other disorders such as depression (Christensen et al., 2004b). Effectiveness of implementation is a critical issue, as the potential public health impact of an evidence-based intervention depends to a large degree on its fit in the real world (Glasgow, 2008).

In this article, we investigate whether the impact of an effective interactive web-based self-help intervention without therapeutic guidance is sustained in terms of improved drinking outcomes when the intervention is made available to the general public. The Drinking Less (DL) intervention has been tested in a randomized controlled trial and shown effective 6 months later (Riper et al., 2008b). To investigate implementation in the "real world," we gave the general public access to DL and then conducted a pretest–posttest study, to determine (1) whether participating DL users showed improved drinking outcomes and (2) whether any improved outcomes in the real world were comparable to the improvements found in the previously published randomized controlled trial of DL (Riper et al., 2008b).

METHODS

The Drinking Less Intervention

Drinking Less (http://www.minderdrinken.nl) is an evidenced-based online interactive self-help intervention without therapeutic guidance designed to curb problem drinking among the adult general population. The intervention is based on motivational, cognitive-behavioral and self-control training principles (Hester, 1995; Miller and Rollnick, 1991; Schippers and De Jonge, 2002). The DL homepage gives access to alcohol-related information, addresses of health services if more or different help is needed, a moderated peer-to-peer discussion forum, and the DL self-help program, which is the core element of the intervention. The program is structured into 4 steps: (1) preparing for action, (2) goal setting, (3) behavioral change, and (4) maintenance. During the preparation phase (1), participants assess their own alcohol intake and their risk in terms of alcohol-related problems and dependence symptoms [using the Alcohol Use Disorders Identification Test, AUDIT (Saunders et al., 1993), their motivation to change, Dutch version of Readiness to Change Questionnaire, RCQ-D (Defuentes-Merillas et al., 2002)]; and the positive and negative consequences of their alcohol consumption. Participants are prompted at step 2 to make decisions about their future alcohol use: either moderating the amount consumed or abstinence. These first 2 steps typically require 15 minutes. The third and fourth steps help participants to achieve a new drinking behavior, preferably within the limits of low-risk drinking guidelines, and subsequently to maintain it and to avoid relapse over time. To this end, the program provides information, interactive exercises, and an electronic drinking diary. Participants are encouraged to complete the course in 6 weeks (Breslin et al., 1998) but, given the self-help nature of the intervention, they may use it for as long as they feel is necessary.

Drinking Less in the Real World

In the period from May 2007 to February 2008, we placed advertisements in national newspapers and on alcohol- and health-related websites to promote awareness of DL. People who were interested in using a web-based self-help intervention to moderate their alcohol use were invited to visit the DL website. An average of 2,750 unique visitors accessed the website's homepage per month (with the notable exception of January 2008 when nearly 6,000 visited the site, probably as a result of New Year's resolutions). The site was accessed an average of 3.84 times per unique visitor. The vast majority (91.5%) lived in the Netherlands. The overall mean time spent per visit (N = 103,746 visits) ranged from 0 to 5 minutes (n = 48,025), to 5 to 30 minutes (n = 31,394), to 30 minutes or more (n = 24,427), with about 1 quarter of the visits lasting over half an hour.

During the 10-month study period, 1,625 of the homepage visitors signed up to utilize the DL self-help program via the website. Registration is anonymous. More males (n = 1,097, 67.5%) registered than females (n = 528, 32.5%). The mean age was 45.30 (SD = 10.84). More than two-thirds were highly educated (n = 1,117, 68.7%), four-fifths were in paid employment (n = 1,304, 80.3%), and almost all were prepared to change their alcohol consumption (RCQ-D contemplation and action stages, n = 1,614, 99.3%). Mean weekly alcohol consumption at baseline was 39.60 standard units (1 standard unit representing 10 g of ethanol). We obtained AUDIT scores for 1,421 participants, 97.7% (n = 1,389) of whom scored ≥8, possibly indicating alcohol abuse or dependence (Conigrave et al., 1995); their mean score was 20.27 (SD = 6.30). The main referral channels were search engines (n = 492, 30.3%), newspapers (n = 490, 30.2%), and another alcohol-related website (n = 267, 16.4%). Virtually all users completed step 1 (n = 1,604, 98.7%) and step 2 (n = 1,595, 98.2%). The maintenance and relapse exercises were used by only 5% of the users (n = 81). The mean visit rate to the self-help program was 23.23 times (n = 1,625, SD = 56.28) and the mean visit rate for the forum was 8.98 (n = 1,625, SD = 49.50).

Not all homepage visitors went on to use the self-help program. To investigate reasons for not doing so, we conducted a poll of homepage visitors, which received 2,984 responses. The reason most often given for not utilizing the self-help program (n = 2,598, 87%) was an intended postponement of participation by a month or more; about 1 in 8 did not intend to use the program at all (n = 376, 12.6%), most of whom indicated that they were not planning to change their drinking patterns (n = 241, 8.1%).

Recruitment, Participants, and Procedure for the Online Survey

We conducted an online pragmatic cohort study following the TREND (DesJarlais et al., 2004) and CHERRIES (Eysenbach, 2004) checklists for reporting on non-randomized and online evaluations. Survey participants were recruited from the users of DL who registered in the period May–November 2007. Users willing to take part in the study returned a consent e-mail and completed an online baseline questionnaire. To obtain data from a purposely heterogeneous population of DL participants and to preserve a low threshold for participation, we required an e-mail address only and did not apply exclusion criteria, except that no users under age 18 were accepted. To address our main research question in this article, we report here the results of the 6-month follow-up; results from the 8-week and 12-month follow-ups will be analyzed in a future publication. Participants received an automated e-mail reminder if they had yet not returned questionnaires 2 weeks after the return date. As a token of appreciation, we drew lots amongst participants who

returned the 6-month questionnaire; the prizes were one iPod nano and five 50-euro gift vouchers.

Primary Outcome Measures

Primary outcome measures were (1) problem drinking, defined as alcohol consumption exceeding the pertinent Dutch guideline for low-risk drinking (Posma and Koeten, 1998)—an average over the previous 4 weeks of more than 21 or 14 standard units (male/female) per week, or 6 or 4 units or more (m/f) on 1 or more days per week; and (2) mean weekly alcohol consumption. Mean weekly consumption was assessed with the Dutch version of Weekly Recall, WR (Cahalan et al., 1969; Lemmens et al., 1988), which records the number of units consumed in the 7 days preceding the assessment point. Units per day per week were assessed with the Dutch version of the Quantity–Frequency Variability Index (Lemmens et al., 1992).

Participants' Uptake and Rating of the Intervention

At the postintervention assessment at 8 weeks, participants were asked whether and to what extent they had used the DL program and, if so, what their opinion was on a scale from 1 (very bad) to 10 (very good).

Power

Originally, the survey was powered to detect clinically significant health gains expressed as a standardized effect size ($d > 0.45$) in a 1-sided test with a power of 80% ($1 - \beta$). The results reported in this article are based on more conventional two-tailed tests. From a clinical perspective, standardized effect sizes of 0.45 are considered to be of medium size (Lipsey and Wilson, 1993).

Analyses

We analyzed the DL in the real world (DL-RW) data and the randomized controlled trial (DL-RCT) data on an intention-to-treat (ITT) basis, imputing missing values by carrying the last observation forward (LOCF). LOCF imputation was the most conservative procedure here, as baseline values were used to impute missing data at 6 months, meaning that most imputed outcomes indicated at-risk drinking. We chose LOCF for our analyses to minimize the risk of overestimating results. ITT analysis enabled us to maintain sufficient power and integrity of baseline conditions. We verified the results by conducting completers-only (CO) analyses on the data from participants who returned the 6-month questionnaires.

We first assessed baseline-to-follow-up changes in alcohol use patterns in the DL-RW group by itself using the McNemar test for problem drinking and paired samples *t*-tests for units of alcohol consumed. We calculated the effect size *d* for the latter data using the formula $d = (M_{pre} - M_{post})/SD_{pre}$ (Cohen, 1997). To compare the effectiveness of DL-RW with that found in DL-RCT (experimental condition only, data sampled in 2003 to 2004), we then pooled the data of these 2 studies, excluding 18 DL-RW participants who had low-risk drinking profiles at baseline (since that was also an exclusion criterion for the RCT). We used *t*-tests, chi-square tests, and logistic regression to assess differences between groups at baseline (at $p < 0.10$). The DL-RW group differed significantly from the DL-RCT group in having higher rates of (1) parental alcohol abuse, $\chi^2(1) = 2.89$, $p = 0.089$; (2) paid employment, $\chi^2(1) = 5.42$, $p = 0.02$; (3) substantial alcohol-related problems, $\chi^2(1) = 3.76$, $p = 0.052$; and (4) low education, $\chi^2(1) = 6.85$, $p = 0.009$. Education level was the only potential confounder, as it predicted one of the outcome measures—mean weekly alcohol intake at 6 months, $t(403.9) = 2.7$, $p = 0.007$, LOCF-imputed. We therefore analyzed the mean weekly alcohol intake at 6 months using ANCOVA, with education level entered as a covariate to adjust for baseline group differences. Subsequently, effect sizes *d* were calculated (Cohen, 1997), and between-group effect size differences were assessed using independent samples *t*-tests (education was not significant as a covariate here and was omitted). Differences between the DL-RW and DL-RCT groups in terms of problem drinking were determined using chi-square tests. We report 95% confidence intervals throughout, as tests were conducted at $\alpha < 0.05$ (2-sided). SPSS version 15.0 (SPSS, Inc., Chicago, IL) was used for all analyses.

RESULTS

Participants' Baseline Characteristics

The baseline sociodemographic and clinical characteristics of the DL-RW group ($N = 378$) are shown in Table 1, alongside those of the DL-RCT experimental group ($N = 130$). Almost all DL-RW participants ($n = 360$, 95.2%) were exceeding one or both problem-drinking criteria at baseline. Mean weekly alcohol intake was 40.9 (SD = 25.2) units. Large majorities were experiencing alcohol-related problems ($n = 352$, 93.1%) and had never received professional help for their problem drinking ($n = 316$, 83.6%). This suggests that the DL intervention was successful in contacting groups of problem drinkers that had not been reached by other health services for their problematic alcohol consumption. More than one-third ($n = 148$, 39.2%) had experienced parental problem drinking.

Predictors of Loss to Follow-Up

Loss to follow-up at 6 months was high in the DL-RW group: 59.5% ($n = 225$) failed to respond to our questionnaire. These were less likely than responders to have been living with a partner at baseline, $b = -0.73$, Wald(1) = 10.29, $p = 0.001$, and more likely to be above the median age of 47, $b = -0.63$, Wald(1) = 8.35, $p = 0.004$.

Treatment Response in DL-RW at 6 Months

Six months after baseline, LOCF analysis showed that 18.8% ($n = 71$) of the participants in the DL-RW group ($N = 378$) were successfully drinking within the guidelines (McNemar $p < 0.001$), as compared to 4.8% ($n = 18$) at baseline, as shown in Table 2. In CO analysis ($N = 153$), 38.6% ($n = 59$) were drinking within the guidelines, compared to 3.9% ($n = 6$) at baseline (McNemar $p < 0.001$). As Table 2 shows, the DL-RW group was also effective in reducing its mean alcohol intake by 7.4 units a week, $t(377) = 6.67$, $p < 0.001$, corresponding to a small standardized effect of $d = 0.29$ (LOCF). In the CO analysis, the decrease was 18.2 units, $t(152) = 7.31$, $p < 0.001$, with an accompanying medium-sized effect of $d = 0.72$.

Uptake and Rating of the Intervention in the DL-RW Group

At 8 weeks postintervention, 196 (51.9%) of the DL-RW participants ($N = 378$) provided information on intervention

Table 1. Baseline Participant Characteristics in the Drinking Less Real-World Setting (DL-RW) and the Randomized Controlled Trial (DL-RCT), in Numbers (Percentages) of Participants, Unless Otherwise Indicated

	DL-RW total group (n = 378)	DL-RCT experimental group (n = 130)	DL-RW at-risk group[a] (n = 360)	Total (N = 490)[b]
Female gender	199 (52.6)	66 (50.8)	191 (53.3)	258 (52.7)
Age (mean, SD)	44.3 (10.5)	45.9 (8.9)	44.5 (10.5)	44.9 (10.1)
High education (academic/professional)[c]	207 (54.7)	89 (68.5)	199 (55.3)	288 (58.8)
Living with a partner	232 (61.4)	75 (57.7)	222 (61.7)	297 (60.6)
Paid employment[c]	311 (82.3)	94 (72.3)	295 (81.9)	389 (79.4)
Parental drinking problems[c]	148 (39.2)	40 (30.8)	141 (39.2)	181 (36.9)
No prior help for problem drinking	316 (83.6)	116 (89.2)	305 (84.7)	417 (85.1)
RCQ-D Contemplation stage[d,e]	255 (81.5)	116 (89.2)	250 (82.5)	366 (84.5)
Problem drinking[f]	360 (95.2)	130 (100)	360 (100)	490 (100.0)
Weekly alcohol intake in standard units (mean, *SD*)[e]	40.9 (25.2)	43.7 (21.0)	42.5 (24.7)	42.8 (23.8)
Alcohol-related problems ≥ 3[c,g]	352 (93.1)	114 (87.8)	340 (94.4)	454 (92.7)

[a]For purposes of comparison with the DL-RCT experimental group, n = 18 were excluded from the DL-RW group because they did not exceed the guideline for low-risk drinking at baseline.
[b]DL-RCT experimental group and DL-RW at-risk group.
[c]Significant difference between DL-RW at-risk group and DL-RCT experimental group.
[d]Assessed with the validated Dutch version (Defuentes-Merillas et al., 2002) of the Readiness to Change Questionnaire (Rollnick et al., 1992).
[e]n = 65 in the DL-RW group did not complete the RCQ-D.
[f]Drinking >21 or >14 units (m/f) in the past week (excessive drinking) and/or drinking ≥6 or ≥4 units (m/f) an average of 1 or more days per week over the previous 3 months (hazardous drinking). A standard unit contains 10 g of ethanol.
[g]Assessed with a validated Dutch questionnaire for problem drinking (Lemmens et al., 1988, 1992).

Table 2. Mean Weekly Alcohol Consumption by Drinking Less Participants in the Real World (DL-RW) at Baseline and 6-Month Follow-Up: Intention-To-Treat (LOCF) and Completers-Only Analyses

		Baseline		6 Months					
	N	*M*	SD	*M*	SD	*t*	df	*p*	*d*
WR[a], intention to treat (LOCF)	378	40.9	25.2	33.5	25.5	6.67	377	<0.001	0.29
WR[a], completers only	153	40.0	26.5	21.8	22.7	7.31	152	<0.001	0.72

LOCF, last observation carried forward.
[a]Mean weekly consumption in standard units of 10 g ethanol according to Weekly Recall.

uptake; 12.2% (n = 24) of them had never used the program, 59.7% (n = 117) had used it once or a few times, and 28.1% (n = 55) more than a few times. Those who had used the program rated it favorably at 7.3 (SD = 1.2). At the 6-month follow-up, 117 participants (31%) returned uptake information; the number of visits to the program in the past 6 months had ranged from 0 to 400 with a median of 6.

Comparisons Between DL-RW and DL-RCT

We next assessed whether the treatment responses in the DL-RW at-risk group differed from those in the DL-RCT experimental group. As noted above, for this analysis we excluded the 18 baseline low-risk drinkers from the DL-RW group, so as to include only problem drinkers in the comparison with the randomized controlled trial problem drinkers. Table 1 shows the baseline characteristics of the 2 compared groups; they did not differ significantly at baseline in terms of either problem drinking or mean units of alcohol consumed weekly, suggesting that both groups were comparable. As Table 3 shows, no significant differences emerged at 6 months between the groups in the LOCF analysis in terms of success rates at drinking within the guidelines, $\chi^2(1) = 1.83$, $p = 0.18$; OR = 1.55, 95% CI: 0.82–3.00, RD = 0.05. The CO analysis found significantly better results for the RP-DL group, $\chi^2(1) = 2.47$, $p = 0.01$; OR = 2.47, 95% CI: 1.24–4.93, RD = 0.18.

In terms of mean weekly alcohol consumption, the LOCF analysis also found no difference between the groups at 6 months, $F(1, 487) = 1.20$, $p = 0.27$, as shown in Table 4. The mean standardized pre–post effect size d in DL-RW was 0.30 (SD = 0.87) and in DL-RCT 0.33 (SD = 0.62), yielding a negligible between-group difference of $d = 0.03$ in favor of the DL-RCT group. The CO analysis found a more favorable outcome for the DL-RW group, $t(215) = 1.99$, $p = 0.048$, with a between-group difference of $d = 0.13$.

DISCUSSION

The Dutch web-based self-help program DL appears to be a feasible and acceptable intervention for problem drinkers in the community. It welcomes around 2,750 unique visitors a month. Almost all registered course participants (n = 1,458, 89.7%) were problem drinkers with an AUDIT score of 8 or

Table 3. Differences Between At-Risk Drinking Less Real-World Participants (DL-RW At-Risk[a]) and the Experimental Group in the Drinking Less Randomized Controlled Trial (DL-RCT exp[b])—Percentages Drinking According to Low-Risk Drinking Guidelines at 6 Months Postintervention: Intention-To-Treat (LOCF) and Completers-Only Analyses

	DL-RW (at-risk)		DL-RCT (exp)		Comparison of conditions				
6 Months	Total *n*	Low-risk *n* (%)	Total *n*	Low-risk *n* (%)	OR	95% CI	RD	χ^2 (df 1)	*p*
Intention to treat (LOCF)	360	51 (14.7)	130	13 (10.0)	1.55	0.82–3.00	0.05	1.83	0.18
Completers only	147	53 (36.1)	70	13 (18.6)	2.47	1.24–4.93	0.18	6.57	0.01

LOCF, last observation carried forward.
[a]Real-world group excluding 18 baseline low-risk drinkers.
[b]Experimental group from randomized controlled trial (Riper et al., 2008b).

Table 4. Differences Between At-Risk Drinking Less Real-World Participants (DL-RW at-risk[a]) and the Experimental Group From the Drinking Less Randomized Controlled Trial (DL-RCT exp[b])—Reductions in Mean Weekly Alcohol Consumption at 6 Months Postintervention: Intention-To-Treat (LOCF) and Completers-Only Analyses

	DL-RW (at-risk)		DL-RCT (exp)		Comparison of conditions				
6 Months	*n*	*M* (SD)	*n*	*M* (SD)	Dif.	95% CI	Test	*p*	*d*
Intention to treat[c] (LOCF)	360	34.8 (25.4)	130	36.7 (24.8)	2.78	−2.21 to 7.76	$F(1, 487) = 1.20$	0.27	0.03
Completers only	147	22.5 (22.9)	70	28.6 (16.8)	6.09	0.04 to 12.15	$t(215) = 1.99$	0.48	0.13

LOCF, last observation carried forward.
[a]Real-world group excluding 18 baseline low-risk drinkers.
[b]Experimental group from randomized controlled trial (Riper et al., 2008a,b).
[c]Results of ANCOVA with education level as covariate (unadjusted mean values); estimated marginal mean values after adjustment for education level (evaluated at 0.59): DL-RW = 34.6; DL-RCT = 37.4.

higher. A total of 378 of them consented to take part in our online pretest–posttest survey (DL-RW). The large majority (83.6%) of these had never had professional help for their alcohol problems. At the 6-month follow-up assessment, 18.8% ($n = 71$) of the DL-RW group were drinking successfully within the limits set by the Dutch guideline for low-risk drinking (as compared to 4.8%, $n = 18$, at baseline) and the group as a whole had significantly curbed its mean alcohol consumption by 7.4 units a week.

Although there were some baseline differences between the characteristics of the DL-RW and DL-RCT groups, their drinking patterns were very similar. The 6-month impact of DL in terms of improved drinking outcomes was also similar for both groups. This indicates that our randomized controlled trial had high external validity and that DL can be used effectively to help adult problem drinkers in the broad community.

The participant groups reached by a number of feasibility studies (Blankers et al., 2007; Cunningham et al., 2005; Koski-Jannes et al., 2007; Linke et al., 2007; Saitz et al., 2004) had similar profiles to those of the DL-RW and DL-RCT groups in terms of (1) main age cohort (35 to 55); (2) high representations of female, employed and highly educated participants in relation to the general problem-drinking population; (3) proportions of severe problem drinkers at baseline; and (4) low rates of prior professional help for alcohol-related problems. Such profiles may be attributable to the reactive self-referral recruitment strategies applied by these and our studies, in contrast to the proactive or opportunistic strategies pursued in primary care studies (Prochaska et al., 2001; Saitz et al., 2004). Reactive recruitment strategies appear more likely than proactive strategies to reach female and more educated participants who are at the ready-for-action stage, whereas the latter strategies reach groups that more closely reflect the population of problem drinkers in terms of educational background and gender, but which have lower levels of readiness to change (Glasgow et al., 2005). This may be a possible explanation for why women are reached so well by reactive web-based self-help interventions (Humphreys and Klaw, 2001; Riper et al., 2008a), but less so by proactive brief interventions in primary care or in traditional addiction services (Copeland and Hall, 1992; Kaner et al., 2007). Feasibility studies measuring treatment response in web-based self-help programs show improved drinking outcomes on a number of alcohol-related variables (Cunningham et al., 2005; Koski-Jannes et al., 2007; Linke et al., 2007).

LIMITATIONS

We recognize several limitations to this study. Only a small proportion of the registered users of DL on the website ($N = 1{,}625$) took part in our online survey (DL-RW, $n = 378$), which may reflect selection between those who were only seeking information on the website and those who proceeded with the intervention proper. We also experienced high loss to follow-up in both the DL-RW and DL-RCT groups. High attrition, as well as low intervention adherence, is well-known features of many studies of web-based self-help

interventions without therapeutic guidance (Christensen et al., 2004a; Eysenbach, 2005; Miller and Wilbourne, 2002). We dealt with our high loss to follow-up analytically as rigorously as possible by conducting ITT analyses, using a conservative last-observation-carried-forward imputation strategy for both groups.

All such studies as this rely on self-reported alcohol consumption measures. Though there is some concern about the reliability and validity of such measures (Hustad and Carey, 2005; Lewis et al., 2007), they are currently the best option available (Whitlock et al., 2004). Indeed, their validity has actually been found to improve in interventions delivered online, which facilitate self-disclosure in comparison to pen-and-paper questionnaires (Kypri et al., 2004a; Lewis et al., 2007).

A further limitation is that our DL-RW study was uncontrolled, so that the data can only show an association between the use of DL and improved drinking outcomes and not whether the association was causal. Our comparison of DL-RW with DL-RCT did, however, suggest evidence for causality.

CONCLUSION

The central question was whether the positive findings of our randomized controlled trial were representative for the routine use of DL in terms of the intended target group and the alcohol-related drinking outcomes (Riper et al., 2008b). Our results point to an affirmative answer. The next question is what this generalizability might imply for the potential to reach the target group. As (Glasgow, 2008) has argued, the impact of interventions stems not only from their effectiveness, but also from their ability to reach sizeable segments of the intended target group. Around 10.3% (1.3 million) of the Dutch adult population are problem drinkers, 90% of whom have never received any professional help for their alcohol problems (Van Dijck and Knibbe, 2005) and 75% of whom have Internet access (Centraal Bureau voor de Statistiek, 2008). We estimate that at least 70% of these drinkers, or 614,250 people, now have sufficient e-skills to work with DL. We expect 3,000 participants to begin the DL self-help program annually, meaning that 0.5% of the entire target group, and nearly 2.5% of the 122,850 problem drinkers in the 35 to 55 age cohort (Van Dijck and Knibbe, 2005), would be reached per year with a single self-help intervention. In itself, this is a conservative estimate if we take into account that other similar interventions are also on offer in the Netherlands (Blankers et al., 2007). In view of these numbers, web-based self-help could function well within a public health approach, particularly as a first step in a stepped care approach to problem drinking. This is important in view of the large-scale availability of DL at reasonable cost, as the cost per additional user is negligible.

While this potential public health impact is inspiring, our results also show that not all problem drinkers benefit from DL. Formidable challenges remain to ensure that additional interventions and recruitment strategies are in place for groups not reached by web-based self-help, including individuals with lower educational backgrounds, problem drinkers who are not motivated to change, and those for whom web-based self-help proves not the answer to their problem drinking. There are also other factors that are essential to effectively translating evidence-based interventions into routine practice. These include the maintenance of service delivery, broad-scale acceptance and adoption by health-care professionals, and the issue of who will provide the interventions and who will pay for them (Glasgow et al., 2005; Hester and Miller, 2006; World Health Organization, 2007). We have not focused on any of these factors. Other crucial questions also remain, such as how to interpret the low rates of intervention compliance for web-based self-help interventions in both trial and routine practice settings. Although our study found high motivation levels for participants and high uptake in routine practice, many participants used the intervention only in part and for a short duration. It would therefore be useful to better understand the underlying reasons for this and to evaluate whether treatment response could be improved by shortening DL to its active components or by somehow improving compliance rates. Replication of our study is also needed, in view of the limited availability of similar studies on translating effective interventions for problem drinking for use in the broader community.

ACKNOWLEDGMENTS

Many thanks to the participants in this study. The study was funded by the Netherlands Organisation for Health Research and Development (ZonMw), grant 50-50115-98-019. We are grateful to Michael Dallas for his English language edit. All authors contributed to the conception, design, and analysis of the study.

CONFLICTS OF INTEREST

There are no conflicts of interest. The authors are independent of the funding body.

REFERENCES

Beich A, Gannik D, Malterud K (2002) Screening and brief intervention for excessive alcohol use: qualitative interview study of the experiences of general practitioners. BMJ 325:870.

Beich A, Thorsen T, Rollnick S (2003) Screening in brief intervention trials targeting excessive drinkers in general practice: systematic review and meta-analysis. BMJ 327:536–542.

Blankers M, Kerssemakers R, Schramade M, Schippers G (2007) Eerste ervaringen met internetzelfhulp voor probleemdrinkers. MGV 62:1032–1043.

Breslin FC, Sobell MB, Sobell LC, Cunningham JA, Sdao-Jarvie K, Borsoi D (1998) Problem drinkers: evaluation of a stepped-care approach. J Subst Abuse 10:217–232.

Cahalan D, Cisin IH, Crossley HM (1969) American Drinking Practices: A National Study of Drinking Behavior and Attitudes. Monograph no. 6.

Centraal Bureau voor de Statistiek (2008) Statistics Netherlands. Available at: http://statline.cbs.nl/StatWeb/publication/?DM=SLNL&PA=71098ned&

D1 = 33-40&D2 = 0-6&D3 = a&HDR = G1&STB = T,G2&VW = T. Accessed April 14, 2009.

Christensen H, Griffiths KM, Jorm AF (2004a) Delivering interventions for depression by using the internet: randomised controlled trial. BMJ 328:265.

Christensen H, Griffiths KM, Korten AE, Brittliffe K, Groves C (2004b) A comparison of changes in anxiety and depression symptoms of spontaneous users and trial participants of a cognitive behavior therapy website. J Med Internet Res 6:e46.

Cohen J (1997) Statistical Power Analyses for the Statistical Sciences (revised ed.). Academic Press, New York.

Conigrave KM, Hall WD, Saunders JB (1995) The AUDIT questionnaire: choosing a cut-off score. Alcohol Use Disorder Identification Test. Addiction 90(10):1349–1356.

Copeland J, Hall W (1992) A comparison of women seeking drug and alcohol treatment in a specialist women's and two traditional mixed-sex treatment services. Br J Addict 87:1293–1302.

Cunningham JA, Humphreys K, Koski-Jannes A (2000) Providing personalized assessment feedback for problem drinking on the Internet: a pilot project. J Stud Alcohol 61:794–798.

Cunningham JA, Humphreys K, Koski-Jannes A, Cordingley J (2005) Internet and paper self-help materials for problem drinking: is there an additive effect? Addict Behav 30:1517–1523.

Defuentes-Merillas L, Dejong CA, Schippers GM (2002) Reliability and validity of the Dutch version of the Readiness to Change Questionnaire. Alcohol Alcohol 37:93–99.

DesJarlais DC, Lyles C, Crepaz N (2004) Improving the reporting quality of nonrandomized evaluations of behavioral and public health interventions: the TREND statement. Am J Public Health 94:361–366.

Eysenbach G (2004) Improving the quality of Web surveys: the Checklist for Reporting Results of Internet E-Surveys (CHERRIES). J Med Internet Res 6:e34.

Eysenbach G (2005) The law of attrition. J Med Internet Res 7:e11.

Glasgow RE (2008) What types of evidence are most needed to advance behavioral medicine? Ann Behav Med 35:19–25.

Glasgow RE, Emmons KM (2007) How can we increase translation of research into practice? Types of evidence needed. Annu Rev Public Health 28:413–433.

Glasgow RE, Magid DJ, Beck A, Ritzwoller D, Estabrooks PA (2005) Practical clinical trials for translating research to practice: design and measurement recommendations. Med Care 43:551–557.

Grant BF (1997) Barriers to alcoholism treatment: reasons for not seeking treatment in a general population sample. J Stud Alcohol 58:365–371.

Harris KM, McKellar JD (2003) Demand for Alcohol Treatment. National Institute on Alcohol Abuse and Alcoholism, Bethesda, MD.

Hester RK (1995) Behavioral self-control training, in Handbook of Alcoholism Treatment Approaches: Effective Alternatives, 2nd ed (Hester RK, Miller WR eds), pp 148–159. Allyn and Bacon, Needham Heights, MA.

Hester RK, Miller JH (2006) Computer-based tools for diagnosis and treatment of alcohol problems. Alcohol Res Health 29:36–40.

Hester RK, Squires DD, Delaney HD (2005) The Drinker's Check-up: 12-month outcomes of a controlled clinical trial of a stand-alone software program for problem drinkers. J Subst Abuse Treat 28:159–169.

Humphreys K, Klaw E (2001) Can targeting nondependent problem drinkers and providing internet-based services expand access to assistance for alcohol problems? A study of the moderation management self-help/mutual aid organization. J Stud Alcohol 62:528–532.

Hustad JT, Carey KB (2005) Using calculations to estimate blood alcohol concentrations for naturally occurring drinking episodes: a validity study. J Stud Alcohol 66:130–138.

Kaner EF, Beyer F, Dickinson HO, Pienaar E, Campbell F, Schlesinger C, Heather N, Saunders J, Burnand B (2007) Effectiveness of brief alcohol interventions in primary care populations. Cochrane Database Syst Rev ???:CD004148.

Kohn R, Saxena S, Levav I, Saraceno B (2004) The treatment gap in mental health care. Bull World Health Organ 82:858–866.

Koski-Jannes A, Cunningham JA, Tolonen K, Bothas H (2007) Internet-based self-assessment of drinking—3-month follow-up data. Addict Behav 32:533–542.

Kramer J, Riper H, Lemmers L, Conijn B, van Straten A, Smit F (2009) Television-supported self-help for problem drinkers: A randomized pragmatic trial. Addict Behav (in press).

Kypri K, Gallagher SJ, Cashell-Smith ML (2004a) An internet-based survey method for college student drinking research. Drug Alcohol Depend 76:45–53.

Kypri K, Langley JD, Saunders JB, Cashell-Smith ML, Herbison P (2008) Randomized controlled trial of web-based alcohol screening and brief intervention in primary care. Arch Intern Med 168:530–536.

Kypri K, Saunders JB, Williams SM, McGee RO, Langley JD, Cashell-Smith ML, Gallagher SJ (2004b) Web-based screening and brief intervention for hazardous drinking: a double-blind randomized controlled trial. Addiction 99:1410–1417.

Lemmens P, Knibbe RA, Tan F (1988) Weekly recall and daily estimates of alcohol consumption in a general population survey. J Stud Alcohol 49:131–135.

Lemmens P, Tan ES, Knibbe RA (1992) Measuring quantity and frequency of drinking in a general population survey: a comparison of five indices. J Stud Alcohol 53:476–486.

Lewis MA, Neighbors C, Oster-Aaland L, Kirkeby BS, Larimer ME (2007) Indicated prevention for incoming freshmen: personalized normative feedback and high-risk drinking. Addict Behav 32:2495–2508.

Lieberman DZ, Huang SW (2008) A technological approach to reaching a hidden population of problem drinkers. Psychiatr Serv 59:297–303.

Linke S, Murray E, Butler C, Wallace P (2007) Internet-based interactive health intervention for the promotion of sensible drinking: patterns of use and potential impact on members of the general public. J Med Internet Res 9:e10.

Lipsey MW, Wilson DB (1993) The efficacy of psychological, educational, and behavioral treatment. Confirmation from meta-analysis. Am Psychol 48:1181–1209.

Miller WR, Rollnick S (1991) Motivational Interviewing: Preparing People to Change Addictive Behavior. Guilford Press, New York.

Miller WR, Wilbourne PL (2002) Mesa Grande: a methodological analysis of clinical trials of treatments for alcohol use disorders. Addiction 97:265–277.

Moyer A, Finney JW, Swearingen CE, Vergun P (2002) Brief interventions for alcohol problems: a meta-analytic review of controlled investigations in treatment-seeking and non-treatment-seeking populations. Addiction 97:279–292.

Posma R, Koeten F (1998) Feiten Over Alcohol (Facts About Alcohol). NIGZ, Woerden.

Prochaska JO, Velicer WF, Fava JL, Rossi JS, Tsoh JY (2001) Evaluating a population-based recruitment approach and a stage-based expert system intervention for smoking cessation. Addict Behav 26:583–602.

Riper H, Kramer J, Keuken M, Smit F, Schippers G, Cuijpers P (2008a) Predicting successful treatment outcome of web-based self-help for problem drinkers: secondary analysis from a randomized controlled trial. J Med Internet Res 10:e46.

Riper H, Kramer J, Smit F, Conijn B, Schippers G, Cuijpers P (2008b) Web-based self-help for problem drinkers: a pragmatic randomized trial. Addiction 103:218–227.

Riper H, Van Straten A, Keuken M, Smit F, Schippers G, Cuijpers P (2009) Curbing problem drinking with personalized-feedback interventions: a meta-analysis. Am J Prev Med 36:247–255.

Rollnick S, Heather N, Gold R, Hall W (1992) Development of a short 'readiness to change' questionnaire for use in brief, opportunistic interventions among excessive drinkers. Br J Addict 87(5):743–754.

Room R, Babor T, Rehm J (2005) Alcohol and public health. Lancet 365:519–530.

Saitz R, Helmuth ED, Aromaa SE, Guard A, Belanger M, Rosenbloom DL (2004) Web-based screening and brief intervention for the spectrum of alcohol problems. Prev Med 39:969–975.

Saunders JB, Aasland OG, Babor TF, Defuentes-Merillas L, Grant M (1993) Development of the Alcohol Use Disorders Identification Test (AUDIT): WHO Collaborative Project on Early Detection of Persons with Harmful Alcohol Consumption II. Addiction 88:791–804.

Schippers GM, De Jonge J (2002) Motiverende gespeksvoering (Motivational interviewing). Maandblad Geestelijke Volksgezondheid 57(2):250–265.

Smit F, Cuijpers P, Oostenbrink J, Batelaan N, de Graaf R, Beekman A (2006) Costs of nine common mental disorders: implications for curative and preventive psychiatry. J Ment Health Policy Econ 9:193–200.

Van Dijck D, Knibbe R (2005) De prevalentie van probleemdrinken in Nederland: Een algemeen bevolkingsonderzoek (Prevalence of Problem Drinking in the Netherlands). Universiteit Maastricht, Maastricht.

Whitlock EP, Polen MR, Green CA, Orleans T, Klein J (2004) Behavioral counseling interventions in primary care to reduce risky/harmful alcohol use by adults: a summary of the evidence for the U.S. Preventive Services Task Force. Ann Intern Med 140:557–568.

World Health Organization (2007) WHO Expert Committee on Problems Related to Alcohol Consumption. Second Report. World Health Organ Tech Rep Ser 1–7. WHO, Geneva.